Let's Discover Science

Book One

David Horsburgh

Introduction

'The usual way is to bawl into a pupil's ears as if one were pouring water into a funnel, and the boy's business is simply to repeat what he is told. I would have the tutor amend this state of things, and begin straight away to exercise the mind that he is training, according to its capacities. He should make his pupil taste things, select them, and distinguish them by his own powers of perception. Sometimes let him do so for himself. I woutd not have him start everything and do all the talking, but give his pupil a turn and listen to him. Socrates, and after him Arcesilaus, made his pupils speak first and then spoke to them. The authority of those who teach is very often a hindrance to those who wish to learn.'

The quotation above is not from any modern author on educational practice, but was written nearly 400 years ago by Montaigne; and even after 400 years it presents ideas which could well be new in many of our schools.

The purpose of the *Let's Discover Science* books is to give the children sufficient basic skills to learn for themselves what they want to learn. The child should, as far as possible, be given those ideas which form the basis of scientific thought Competition and grading can well be dispensed with in a course of this nature: the children should be encouraged to cooperate with each other in experimenting and in enjoying the beauties of scientific discovery and learning from their peers should be a normal part of everyday classroom activity.

Before the child can be led to any important concepts of science, it is important to *break down* certain concepts which already, perhaps, are making their way into his mind through other aspects of his education.

The first is the idea that the textbook is some kind of divine writ to be accepted without question, swallowed without digestion, and regurgitated in the examination.

The next: that to every question there is one correct answer, and only one correct answer, and that this correct answer must always be given in the words of the book.

The next: that every effect is due to only one cause and not as so often happens, to a multiplicity of causes.

How can the teacher break down some of these fallacious concepts? By encouraging the child to ask'questions, to conduct experiments *for himself*- and to make guesses. By giving children plenty of practice at suspending their judgement and being prepared to wait and observe rather than to jump to quick conclusions; and even by the teacher and pupils occasionally saying together, 'We don't know'; followed by, 'Let's find out.'

The five books in the series are designed to give children a number of skills and concepts. While the text deals, of course, with scientific matters, the emphasis must always be on learning the skills and concepts and not on learning the information contained in the text.

Observing, recording, the analysis of such recordings, and the practical applications of such analyses, are at) introduced from the earliest stages. In addition, a number of practical skills have been taught:

learning to draw, to copy and to trace

learning to use language accurately

learning to guess with reasonable accuracy

learning to work from printed instructions.

The pages of the book should form only the beginning of the child's quest for scientific knowledge. Children should be encouraged to apply the skills and concepts they acquire from the book to every aspect of their environment and life.

A few notes for the teacher with regard to certain pages of the text have been printed at the back of the book.

David Horsburgh

My name is .....

I have .... hands and

.... feet. I have .....

fingers and .... toes.

I have ..... brothers

and ..... sisters. I go

to school in .....

I live in .....

I am going to

learn science.

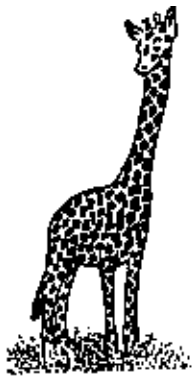
Animals

an elephant

. . . . . .

a camel

. . . . . .



a giraffe

. . . . . .

Birds

a crow

. . . . . .

a kite

. . . . . .

a sunbird

. . . . . .

Insects

a beetle

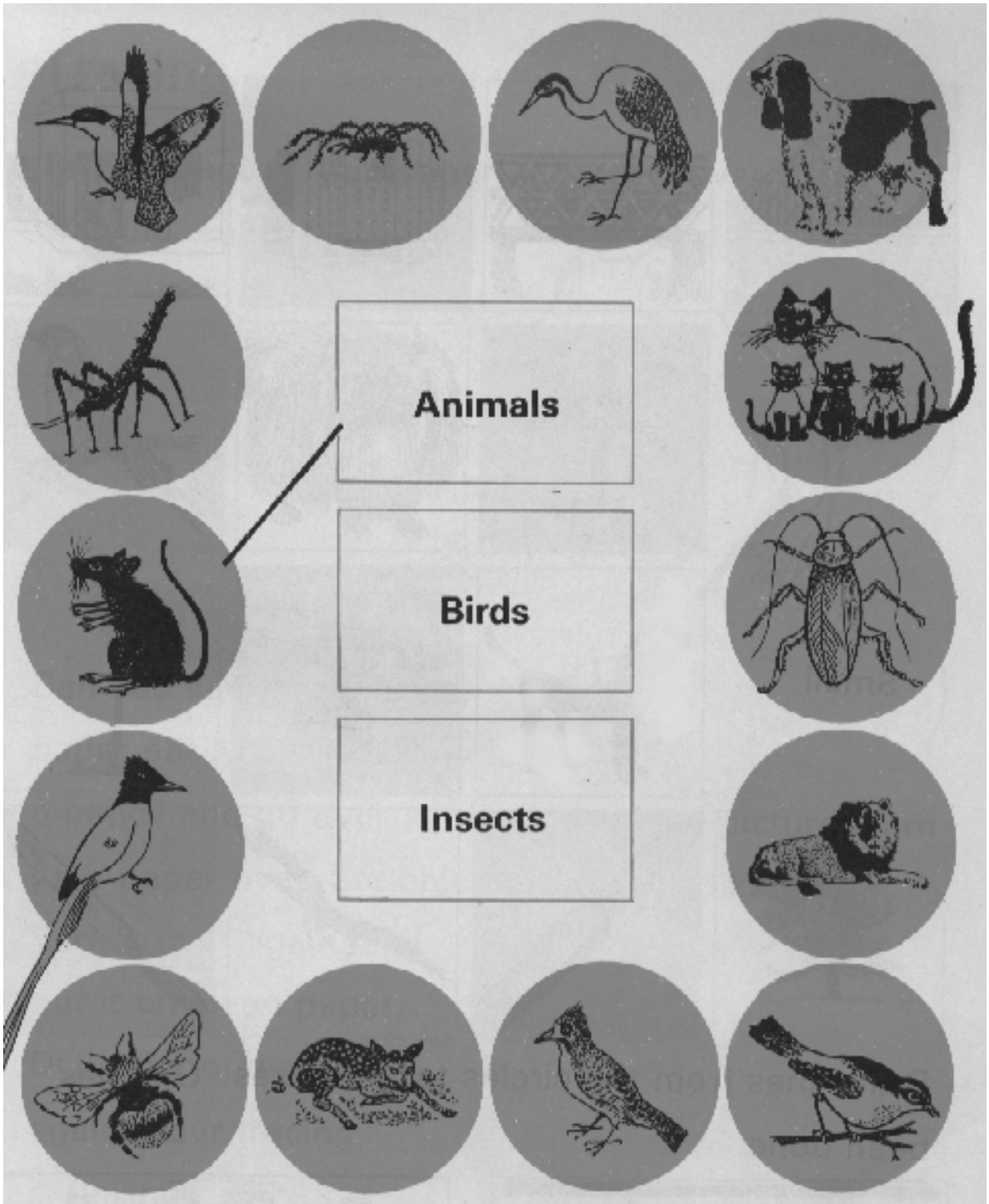
. . . . . .

a spider

. . . . . .

a cricket

. . . . . .

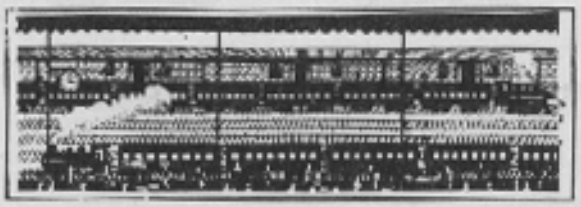
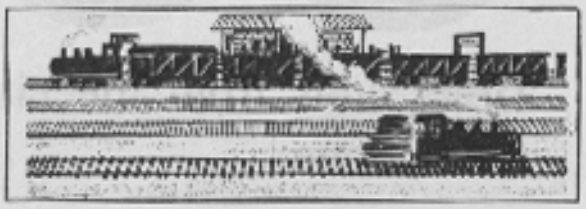


Draw lines from the circles to the boxes. **Rat** has been done.

Big

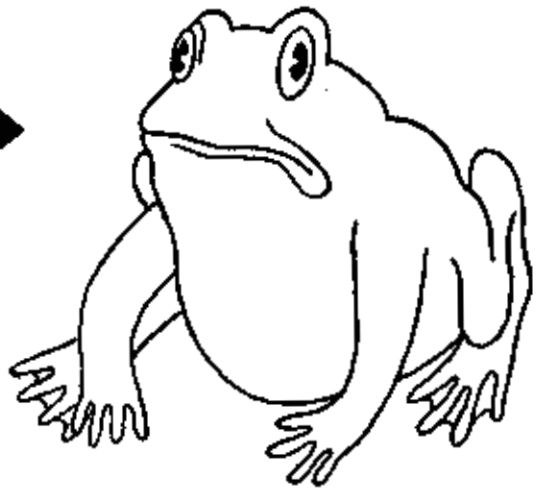
Small

Draw lines from the circles to the boxes. One has been done.

Tracing

Take a piece of thin paper and put it over this drawing.



Can you see through the paper easily? Good. Now take a pencil and go over all the lines of the picture. Turn your paper over. Scribble on the back, like this:

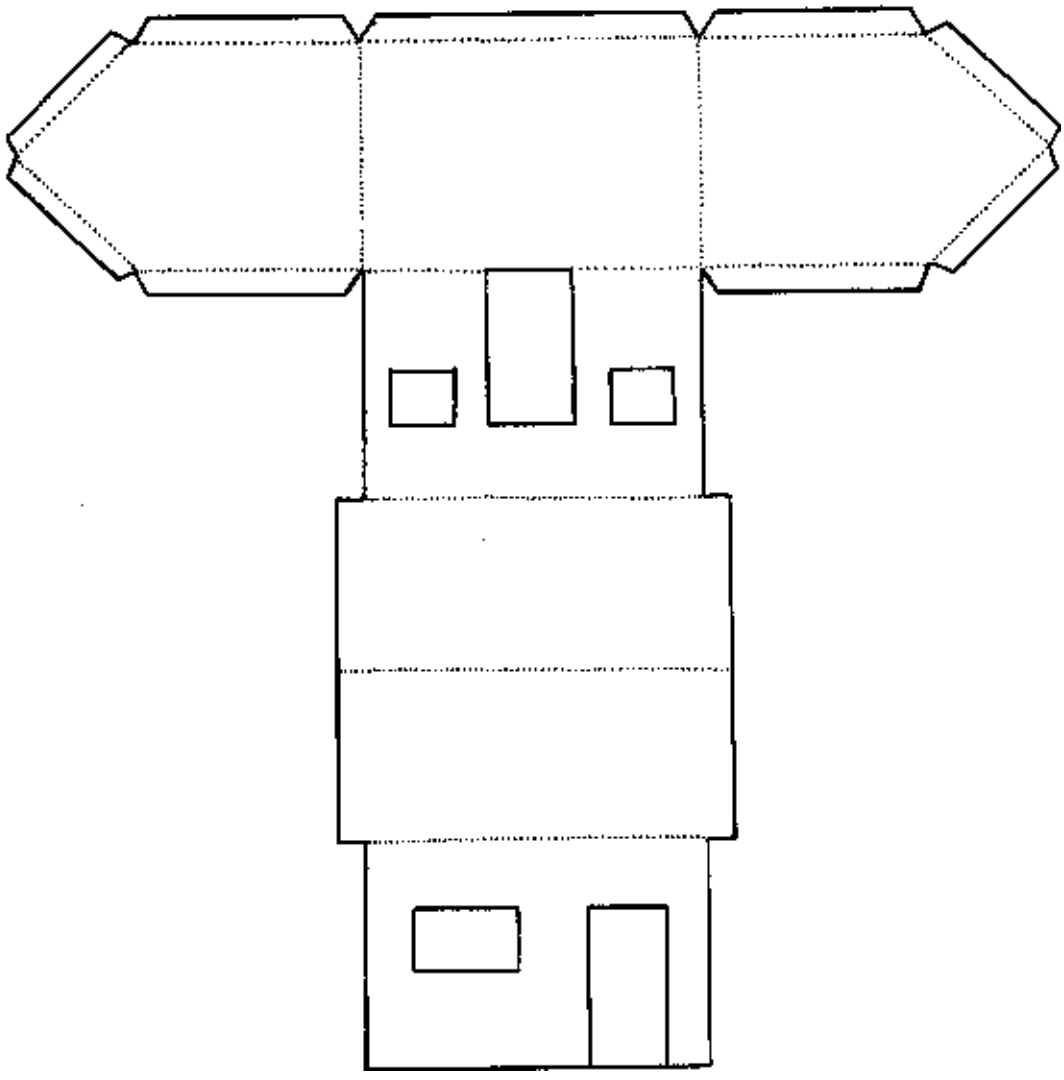
Turn it over again, and put it on clean paper. Draw the outline again. Your tracing is finished.

A model house

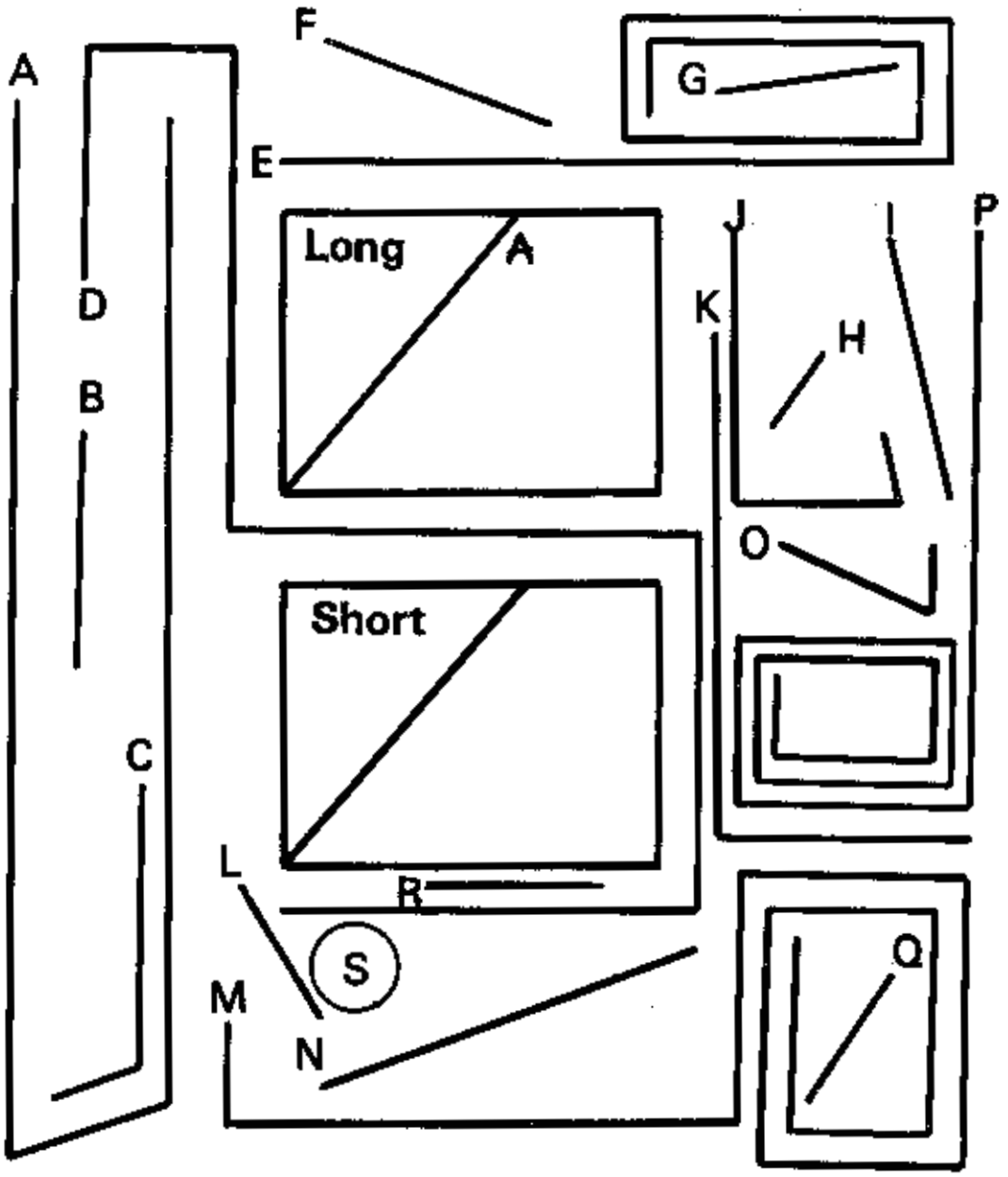
Copy or trace the diagram below on to paper or card.

_____ means CUT

..... means FOLD

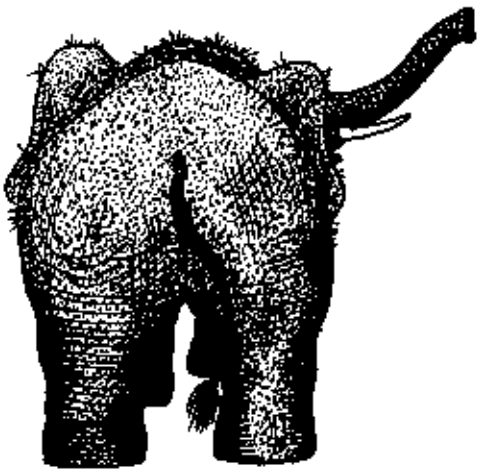


Long and short



Put the letters in their correct boxes. A has been done for you. S is difficult. Make another puzzle like this for your friends.

Mr Elephant, Mr Rat and Mr Ant



Mr Elephant

Mr Rat

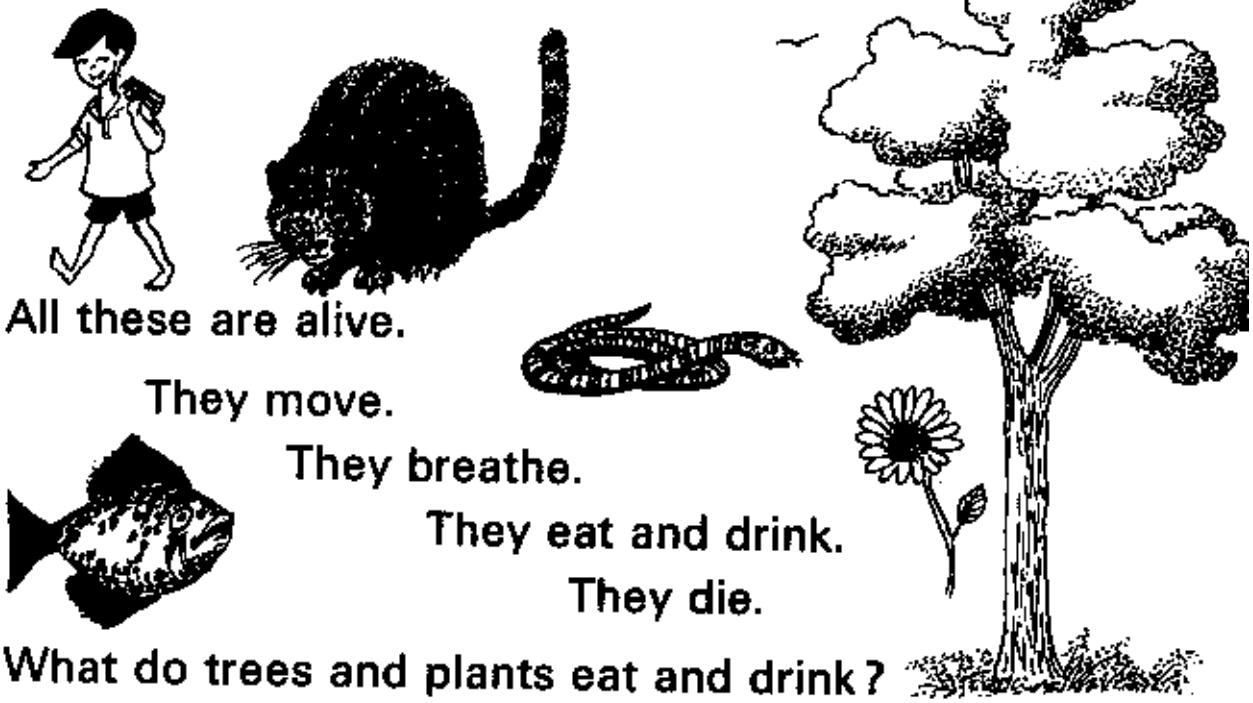
Mr Ant

Mr Elephant says: 'Mr Rat is small. He has a short tail.' Mr Ant says: 'Mr Rat is very big. He has a long tail.'

Who is right? Mr Elephant or Mr Rat?

Make a list of ten things which Mr Ant thinks are big, and ten things which Mr Elephant thinks are small. What do you think they are? Big or small?

Alive and not alive



All these are alive.

They move.

They breathe.

They eat and drink.

They die.

What do trees and plants eat and drink?

All these are not alive.

They do not move.

They do not breathe.

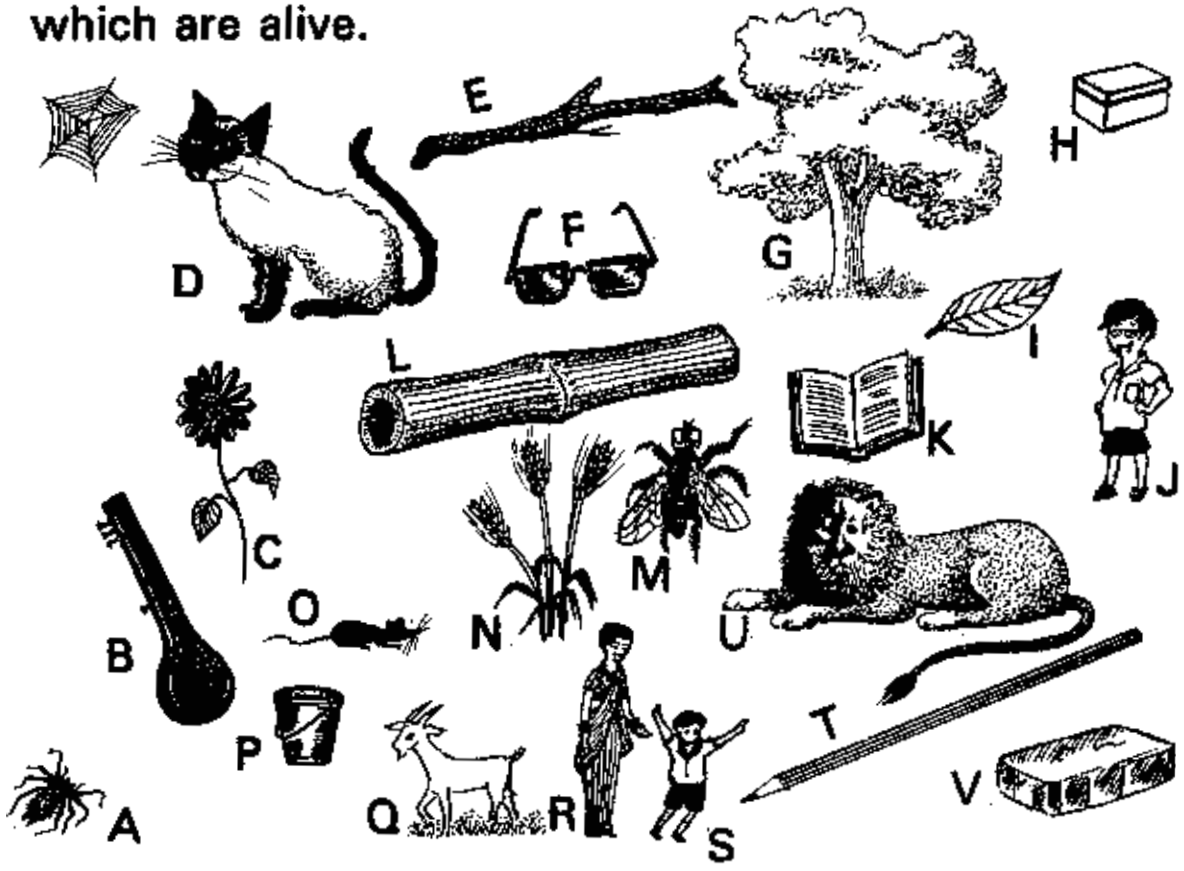
They do not eat or drink.

They do not die.

If you throw a stone, it moves. Is it alive?

Alive and not alive

Put a circle round all the things on this page which are alive.



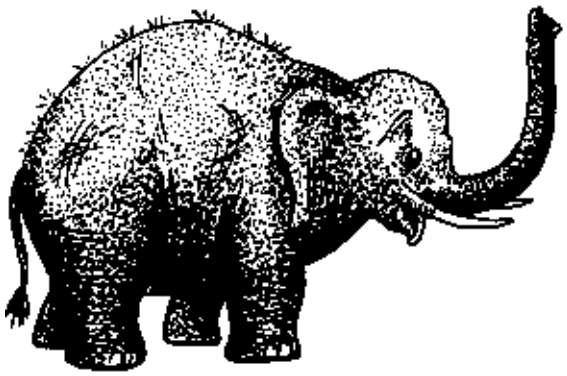
Put the correct letters in the boxes:

ALIVE	NOT ALIVE

Can you name all the things in the picture?

How many letters are missing?

Sounds



Mr Elephant

Ravi

Mr Ant

Ravi is walking very quietly.

Mr Elephant says: What a tiny sound!

Mr Ant says: What a HUGE noise!

Put these sounds in the right boxes. Use the letters.

Loud	
Soft	
Loud or Soft	

A Your radio
B Thunder
C A clock ticking
D A dog barking
E A leaf falling
F A whistle
G A pen scratching on the paper
H A lorry passing the school
I A flute
J A glass breaking
K A baby crying
L The wind in the trees
M A shouting man
N A whispering girl
O Your teacher teaching
P A boat going across the river

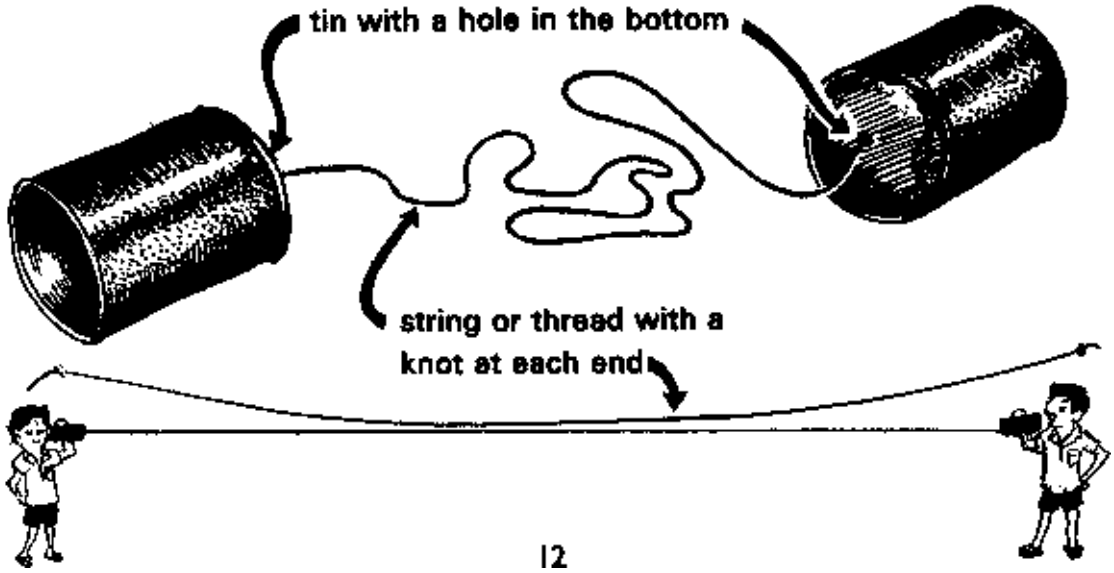
Listening to sounds

Scratch the desk very gently. Can you hear it? Now put your ear on the desk. Can you hear it now?

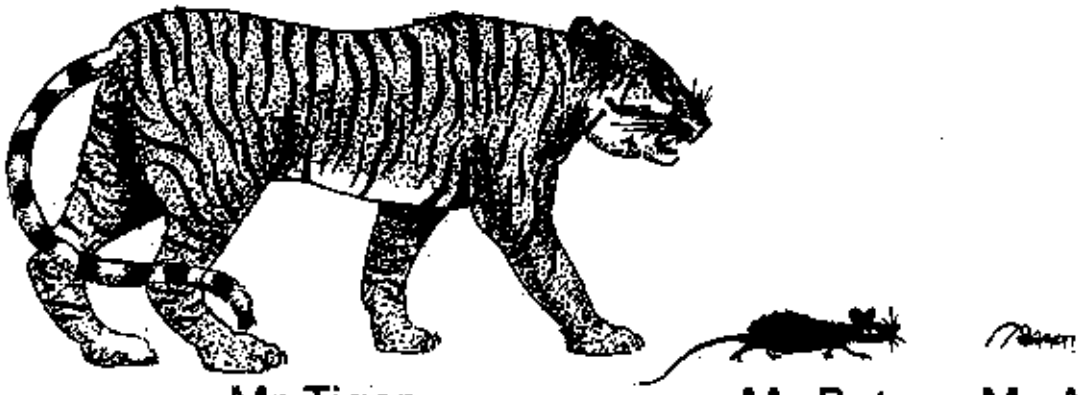
Tap a pencil with your fingernail. The sound is soft. Put the pencil between your teeth. Now tap the pencil and listen. Loud or soft?

A telephone

Make a telephone. You can talk to your friend a long way away.



Fast and slow



Mr Tiger Mr Rat Mr Ant

Mr Tiger says: 'Mr Rat walks very slowly.'
Mr Ant says: 'Mr Rat walks very quickly.'
Who is right?

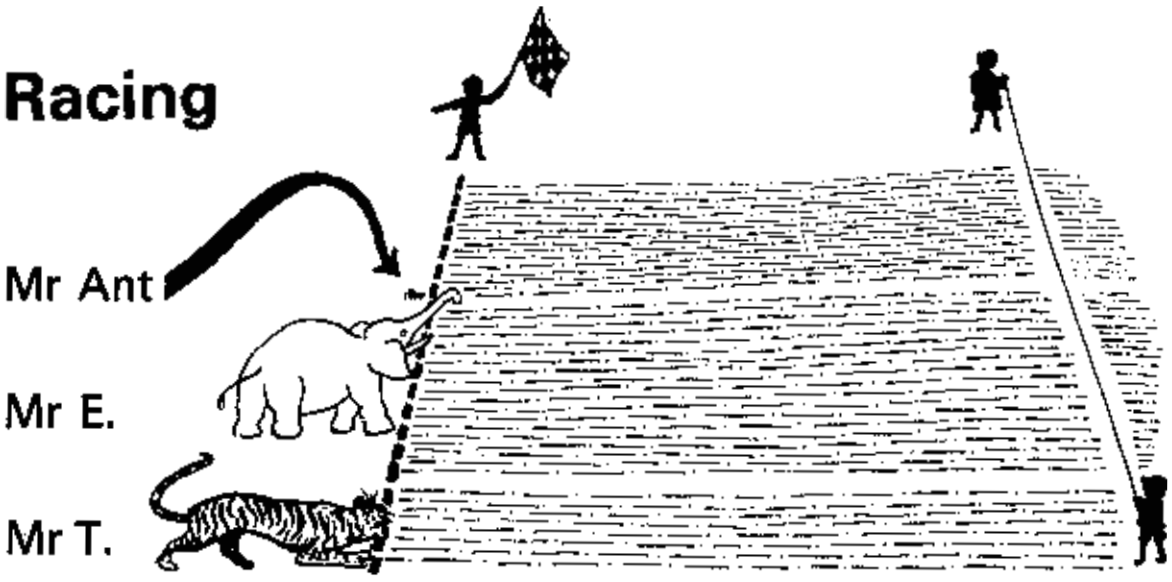
Put the letters in the correct boxes:

A B C D E

F falling rain G a car H a railway train
I the Sun J a growing tree K a falling leaf

Fast	Slow
Fast or slow	I don't know.

Racing



Who will come first? Mr Tiger. Then Mr E.
Then Mr Ant. The order will be T. E. A.

Race 2

Who will come first? Who will come last?
Put the letters in the right order.
First ..... Last

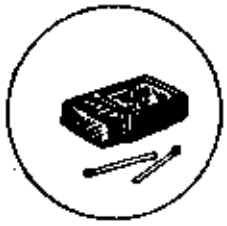
Make more races like this.
Use 5 of your friends
5 animals
5 things with wheels.

Hard and soft

Put the letters in the correct boxes below :

A

B

C 

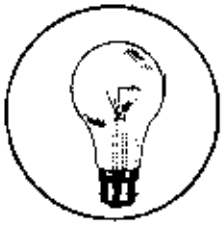
D

E

F

G

H

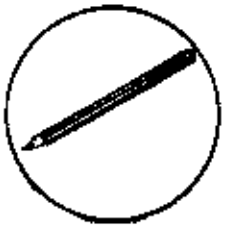
I 

J curds K milk L a stone M a mud pot
N your teeth O your cheeks P a wooden box
Q a tin box R a knife S a pencil T the moon
U a piece of string V a piece of wire

Hard	Very hard
Soft	I don't know

Will it break?

Put the letters in the chart below. Some letters will go in two or three places.

A B  C D

E F G H

I a tomato J your head K a scooter L a twig

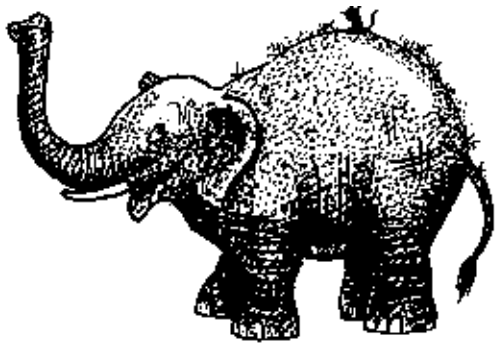
M a plastic cup N a balloon

Will it break		Yes	No	Perhaps	I don't know
	if it falls?	A	B		
	if you hit it?	A		B	
	if you bite it?			AB	
	if Mr Elephant sits on it?	A			B

A and B have been done for you.

Heavy and light

Mr Ant says:
Mr Rat is very heavy.



Mr Elephant says:
'Mr Rat is very light.'

Mr Rat says:

An ant is ..... [heavy/light]
A dog is .....
A boy is .....
A feather is .....

Mr Elephant says:

A rat is ..... [heavy/light]
A man is .....
A house is .....
A mountain is .....

You say:

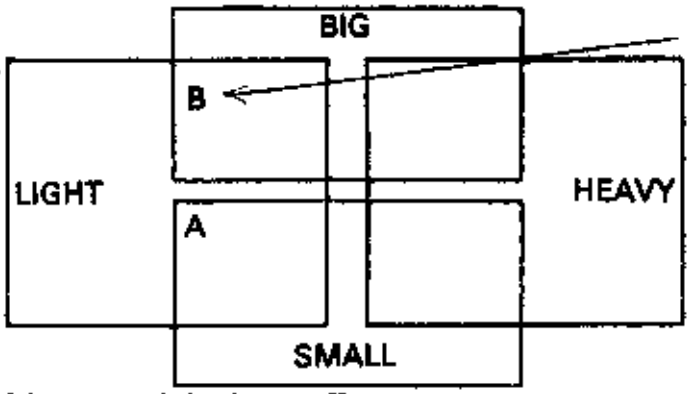
A ..... is heavy.
A ..... is light.
A ..... is very heavy.
A ..... is very light.

Sorting things

Read this list

A a feather
B a newspaper
C a mountain
D a small stone
E a big paper kite
F a pin
G an aeroplane
H an elephant

Now sort them into the correct boxes below.
A and B have been done for you.



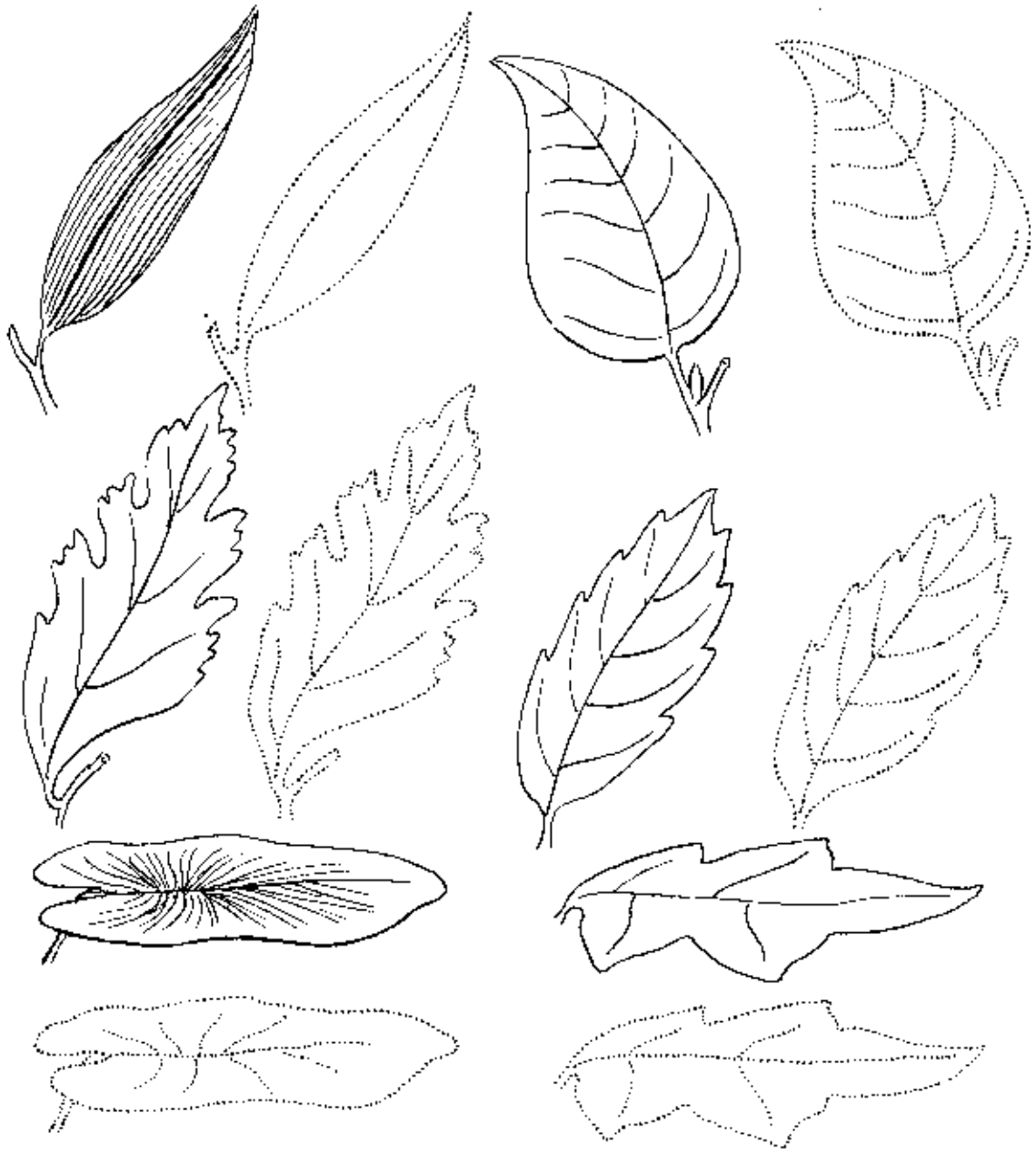
● goes here because it is BIG and LIGHT, so it must be in the **big** square and the **light** square.

Now add these to your squares.

I a bottle of ink
J a fat baby
K a truck
L a train
M a pencil
N a nib
O a very large piece of paper
P a candle

Make a square diagram of your own.
Make a list of things.
Give it to your friend to do.

Leaves



Go over the dots.

Trace the leaves into your exercise books.

See if you can bring six different leaves to class.

Collecting and sorting

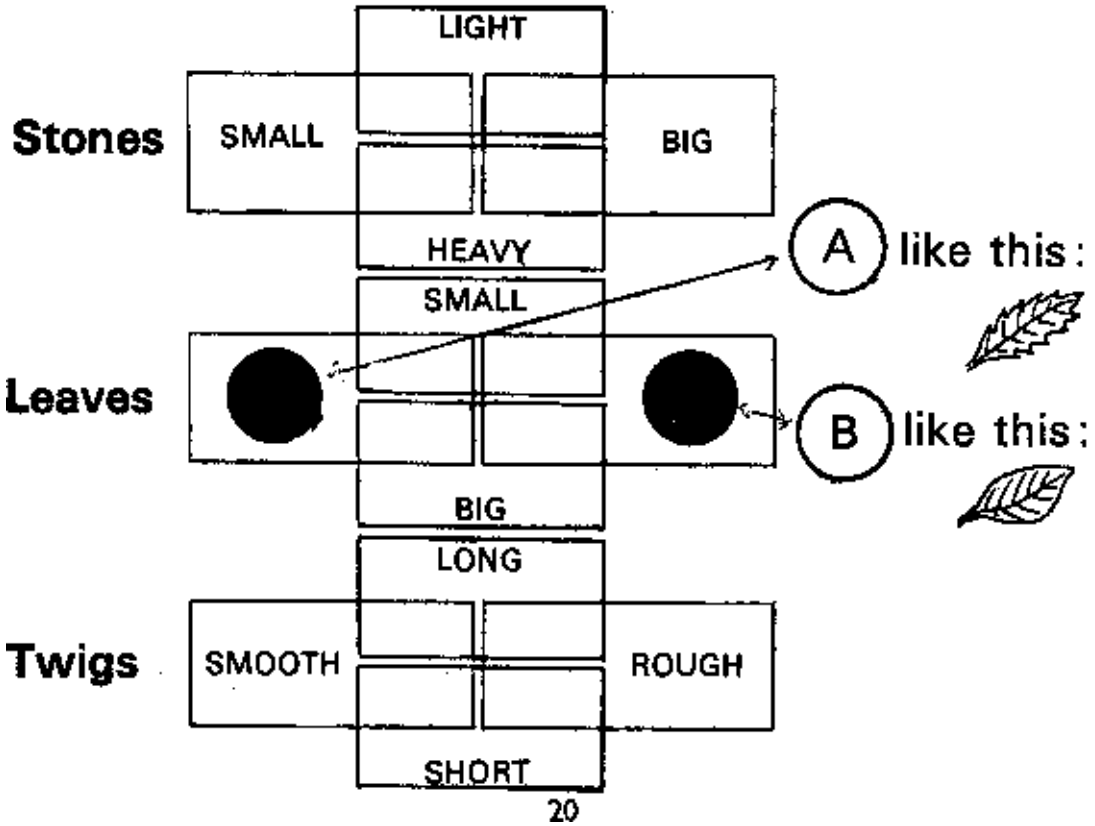
Collect some of the following:

stones

leaves

twigs

Make big diagrams, like the ones shown below, in your exercise books or on the sand in the playground. Sort your stones, leaves and twigs into the correct boxes.



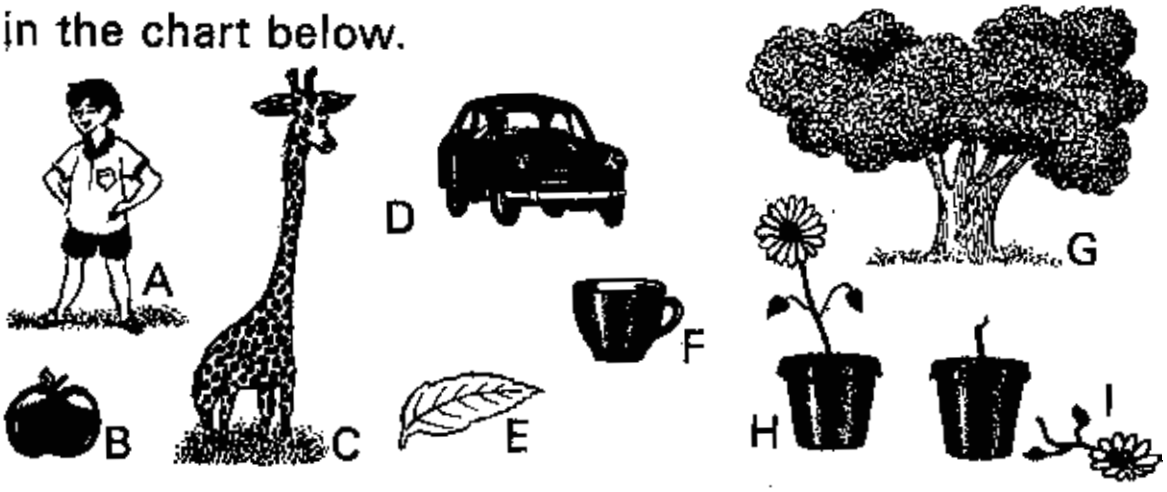
Growing

Do you grow? How much do you grow in a year?

Guess

A nothing	B 1 centimetre
C 5 centimetres	D 10 centimetres
E 20 centimetres	F 1 metre
G 2 metres	

Which of the following things grow? List the letters in the chart below.



J your fingernails K your teeth L your hair
M a pin N a box of matches O a mountain
P a cloud Q an old man R a pencil S the Sun

GROWING	NOT GROWING	I DON'T KNOW

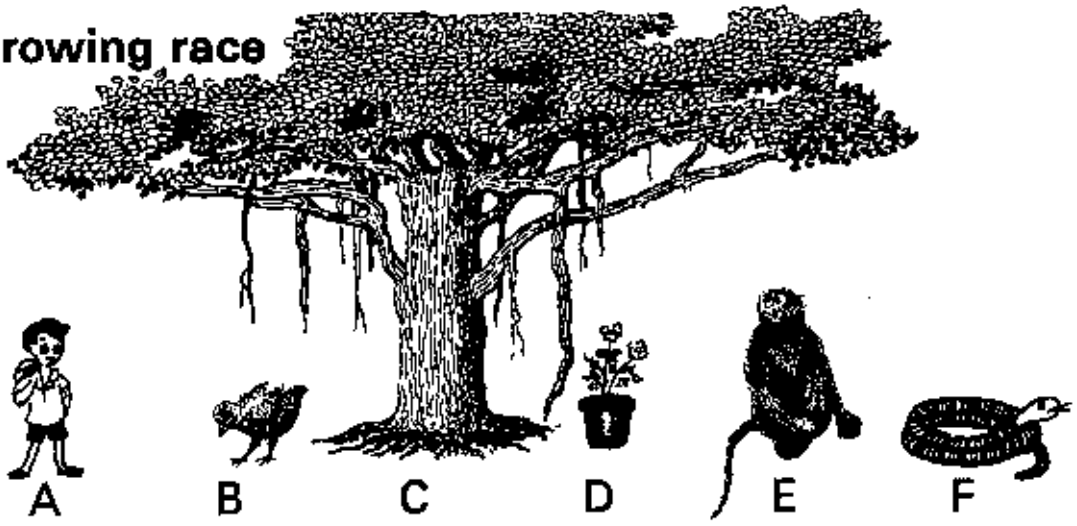
Growing

A baby grows to full size in 21 years.

A bean grows to full size in 42 days.

A butterfly grows to full size in 24 hours.

Growing race



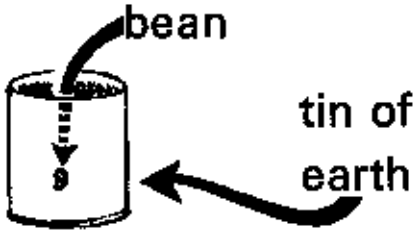
Who reaches full size first?

Put them in order here:

. . . . . .

Ask your teacher to help you.

Plant a bean or a pea.



Water it
every day.
Watch it grow.

Water

Put the letters in the chart below:

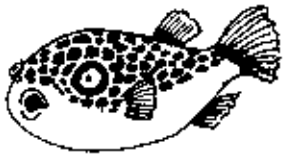
A

B

C

E

D


F

G

H a bed bug I a kingfisher J a frog

K a very old man L an ant M a mango tree

Can live under water	Cannot live under water	Can live without water	I don't know

Make another list of your own and put the letters in your chart.

Water

Bring to school: a cup or a tin a little sugar
a little salt a little uncooked rice

Fill the cup with water. First, put in salt.
Empty the water. Then sugar. Empty the water.
Then rice.

A
water and salt

B
water and sugar

C
water and rice

It disappears.	
You can still see it.	
You can taste it.	

Floating

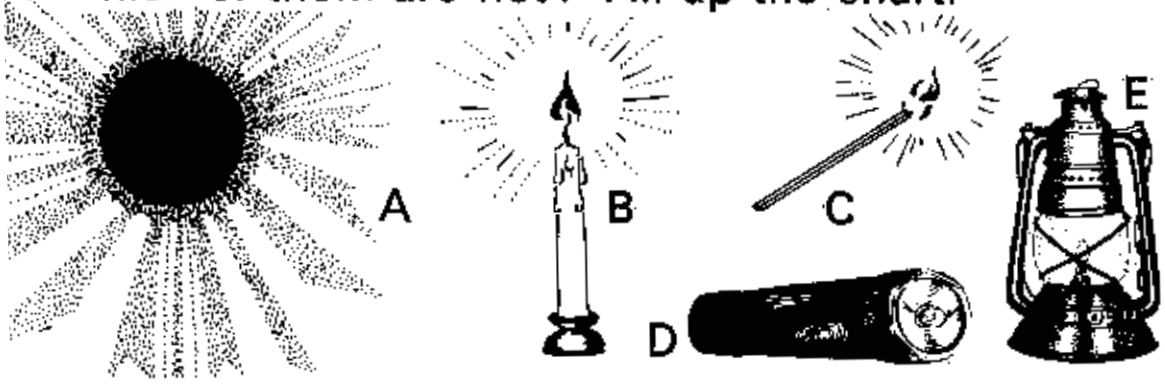
Put these in water, one by one. Fill the chart up.

a matchstick a piece of paper a piece of cloth
a nail a paper clip a grain of rice a pin

FLOATS	SINKS at once	floats and then sinks

Heat and light

Which of these things give light?
Which of them are hot? Fill up the chart.



F a kettle of hot water G an electric light bulb
H a stone in the Sun I kerosene stove
J a wood fire K a house on fire
L a fresh chappatti

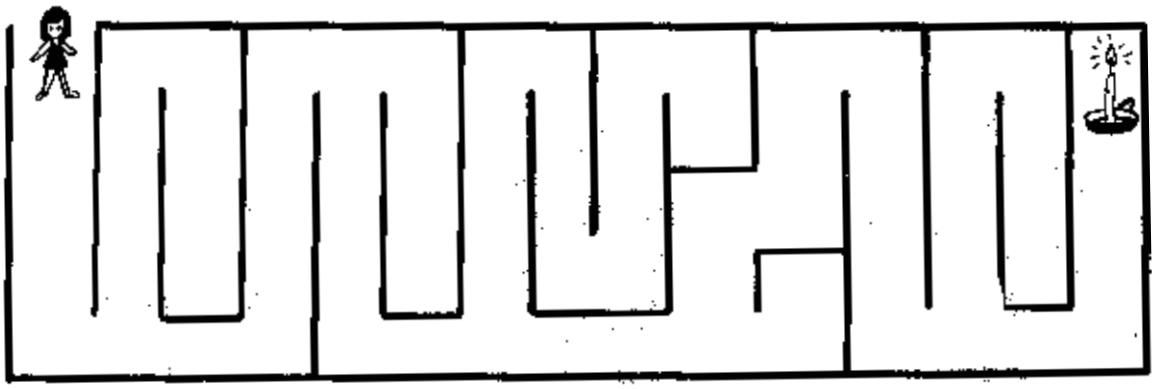
HOT	VERY HOT	GIVES LIGHT	DOES NOT GIVE LIGHT

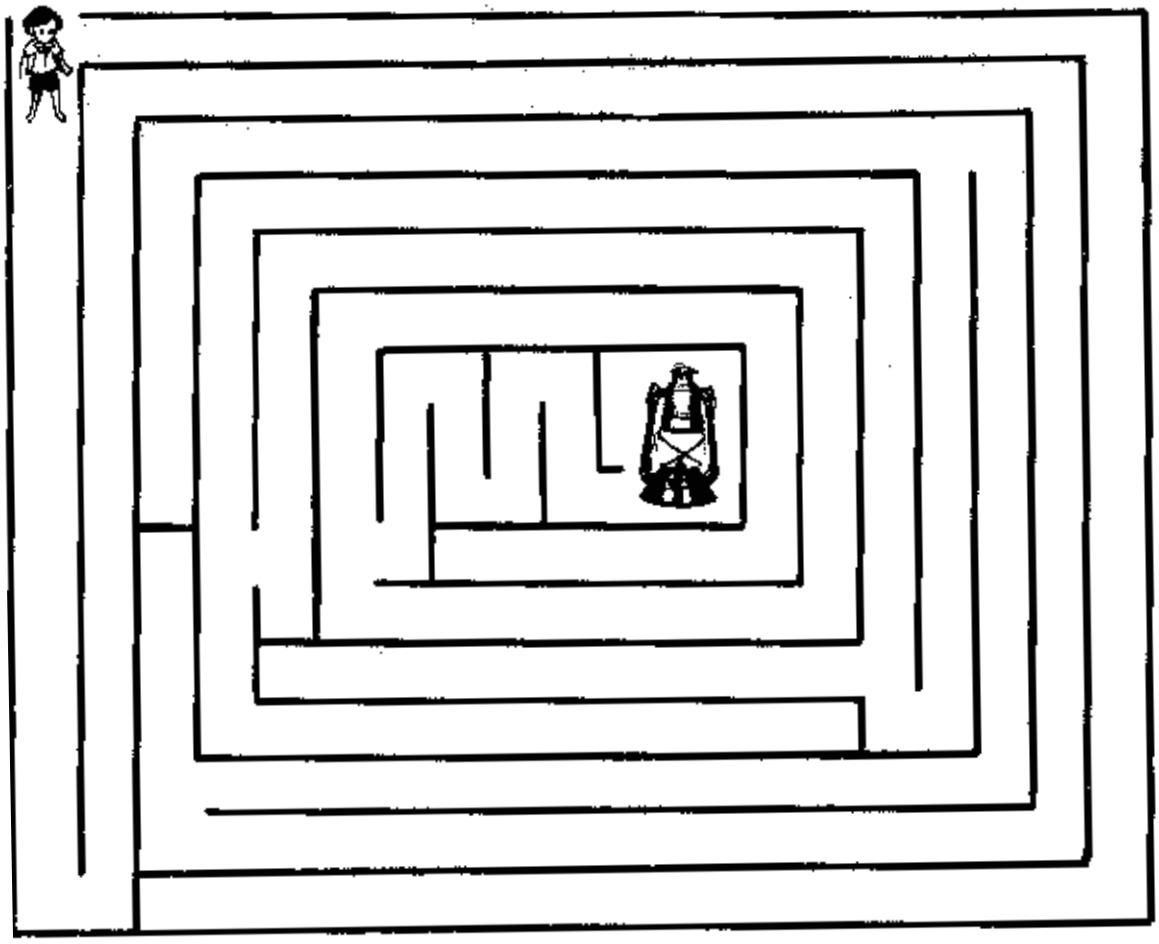
Write B by the side of each thing in the list below which burns :

charcoal a knife paper wood trees nails
dry leaves wet leaves cotton pins shirts shoes
50p coins gold earrings bricks saris pencils
empty tins bottles rupee notes ink sugar sand

Write I D K (I Don't Know) if you don't know.

Finding the light



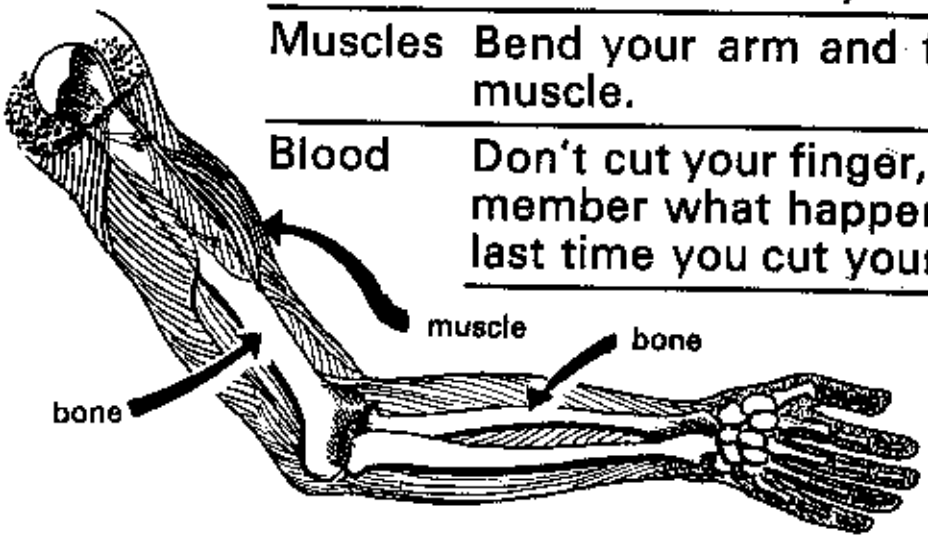


See if you can help the girl to find the candle and the lamp. DO NOT CROSS ANY LINES.

Your body

Your body contains

Flesh	Pinch your flesh.
Skin	Pinch your skin.
Bones	Feel the bone in your elbow.
Muscles	Bend your arm and feel the muscle.
Blood	Don't cut your finger, but remember what happened the last time you cut yourself.



Copy or trace the drawing into your exercise books.

Guess

How much blood do you have in your body?

1 bottle full		
2	3	4
more than 4		

How many bones do you have in your body?

20	75	100
200	300	
more than 300		

Bodies

Many creatures have bodies different from you.

A

B

C

D

E

F

Here are some parts of their bodies which you do not have:

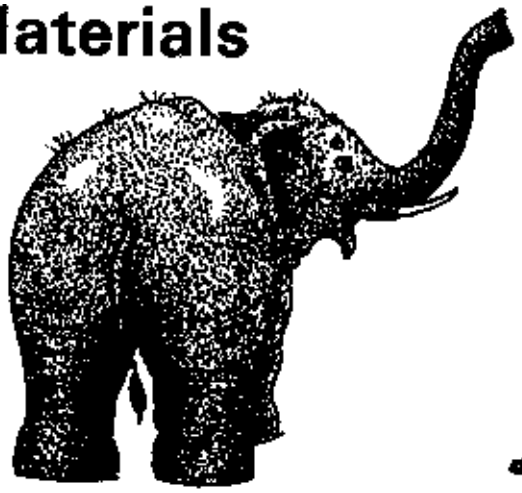
claws a trunk very long legs very big teeth
a tail a beak wings no legs horns
very thick legs a hump a very thick skin.

Which parts belong to which animals? Write them here:

A has .....
B has .....
C has .....
D has .....
E has .....
F has .....

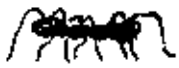
Why do animals have the bodies they do?
Get your teacher to tell you.

Materials



Mr Elephant

twig



Mr Ant

Mr Elephant says : 'Breaking a twig is very easy.'
Mr Ant says : 'Breaking a twig is impossible.'

Look at the things in the list below. Collect as many as you can. Then put them one by one in a bucket of water. Then try to break or tear them. Then fill in the chart.

A a glass B blotting paper C a nail D a pin
E a thin piece of wood F a piece of cloth
G a matchstick H a cup I a mud pot J a brick.

You can break it.	You can't break it.	You can tear it.	It soaks up water.

Materials Exhibition

Bring as many small things to class as possible.
Here are some ideas :

paper of different kinds wood glass
brass silver iron cloth plastic tin
feathers leaves bark

Join your things with those of your friends.

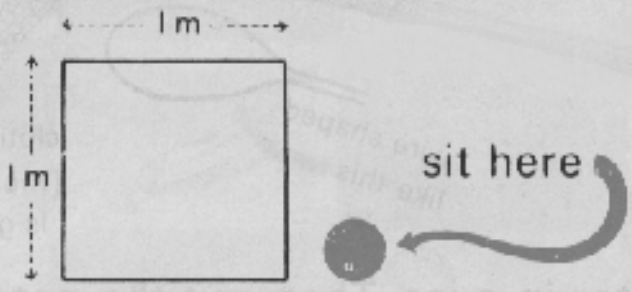
Put the things in groups, make labels and have an exhibition, like this :

METAL	GLASS	WOOD

Make a list of all the things.
Make a chart like the one on page 29.
List the things in the correct columns.
Which things are shiny and which are rough ?
Think of some more things to bring.
Some ideas : sugar string beans
Your ideas : .....
.....

Living things

When you go home today, go to a park or piece of open ground. Mark a square, like this :

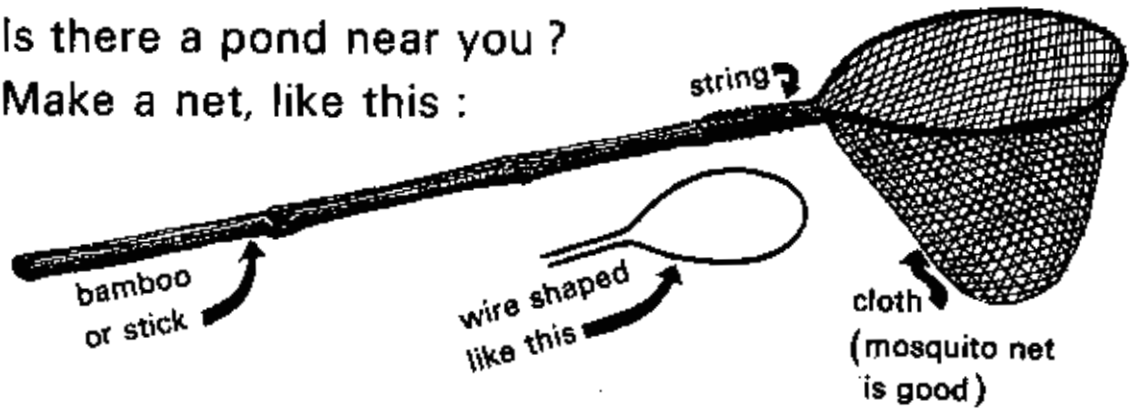


See how many living things you can see in the square in ten minutes. Make a chart and list the number of ants, beetles, flies, etc. Are all ants the same size and colour ? Are all flying insects the same ? Did anything fly over your square ?

Can you recognize these ?

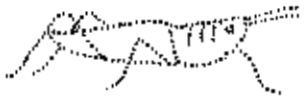
Pond Water

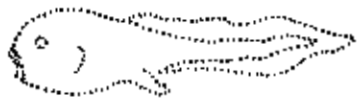
Is there a pond near you ?
Make a net, like this :



Put some water in a jar. Then put the net into the pond and see what is in it. Put the things in your jar of water.

Some things that live in ponds :





nymph

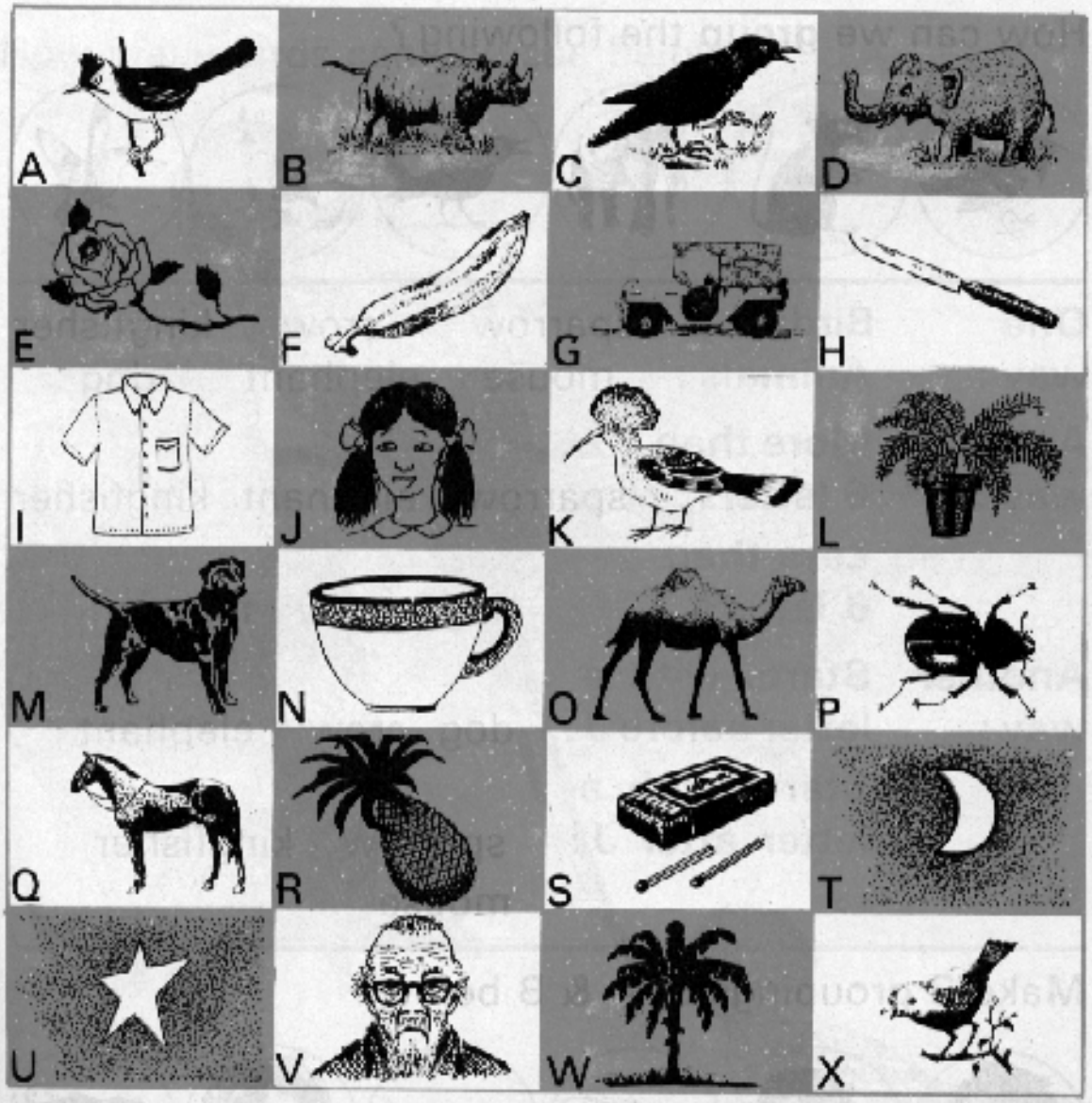
. . . . . .

tadpole

. . . . . .

Draw some of the things you found in your net.

Sorting



Make your own chart. Use these headings and list the letters.

PLANTS ANIMALS BIRDS HUMAN BEINGS

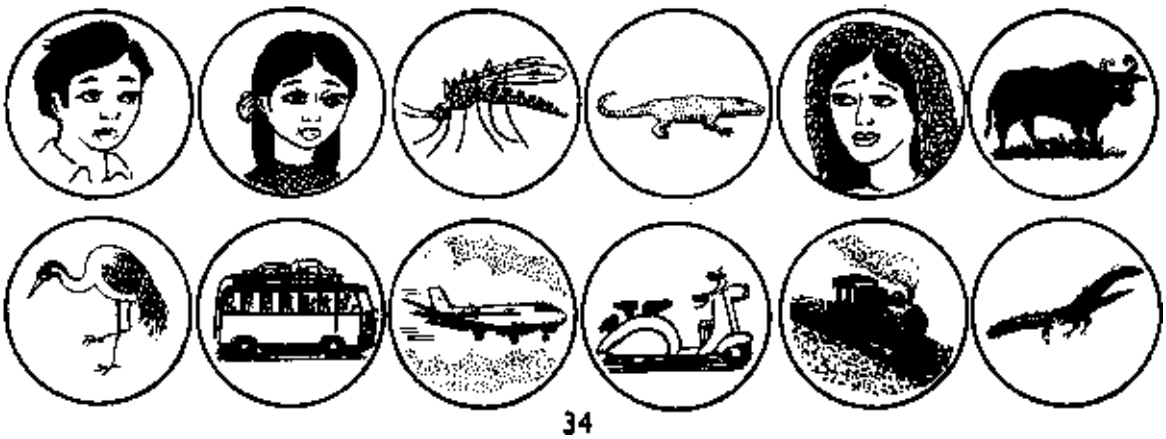
THINGS MADE BY SOMEONE THINGS NOT MADE BY ANYBODY

Grouping

How can we **group** the following ?

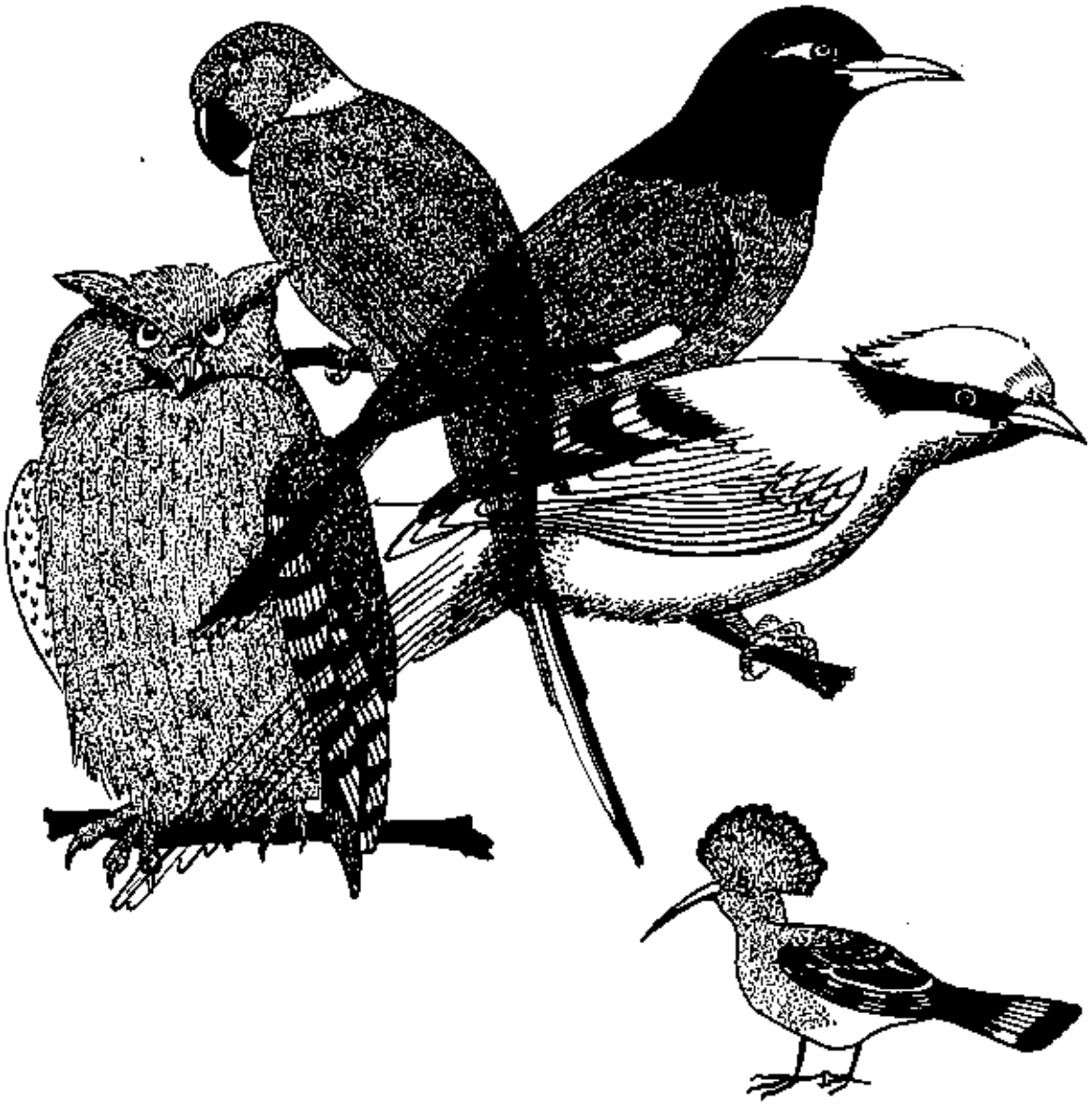
One way :	**Birds :**	sparrow crow kingfisher
	Animals :	mouse elephant dog
Another way :	**More than 6 letters :**	sparrow elephant kingfisher
	Less than 6 letters :	dog crow mouse
Another way :	**Starts with a letter before J :**	dog crow elephant
	Starts with a letter after J :	sparrow kingfisher mouse

Make 3 groupings of A & B below :



Birds

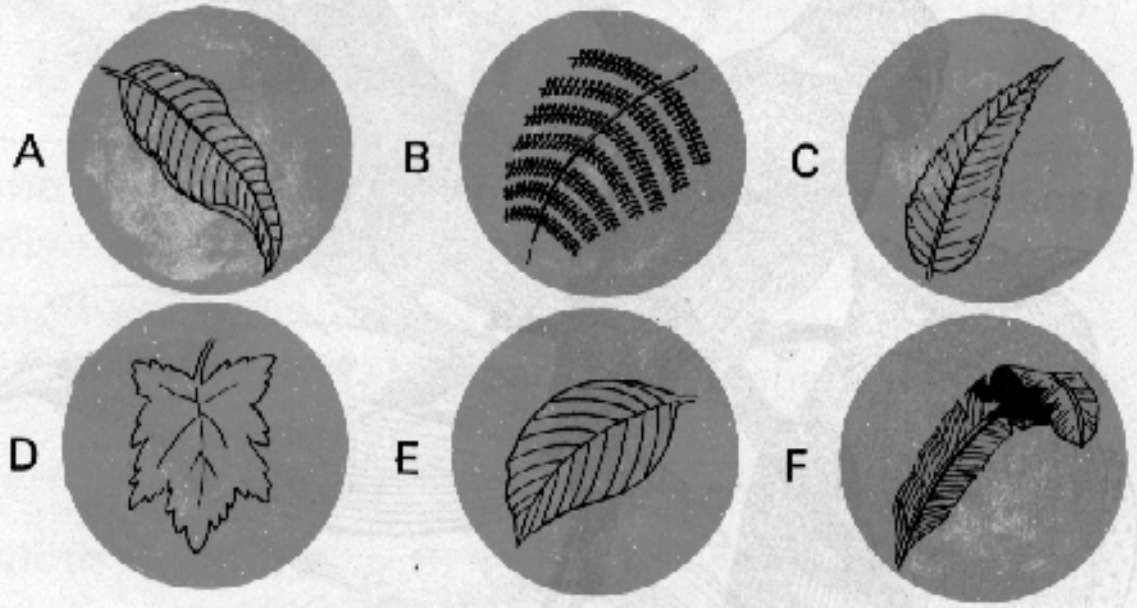
How many birds can you see below?



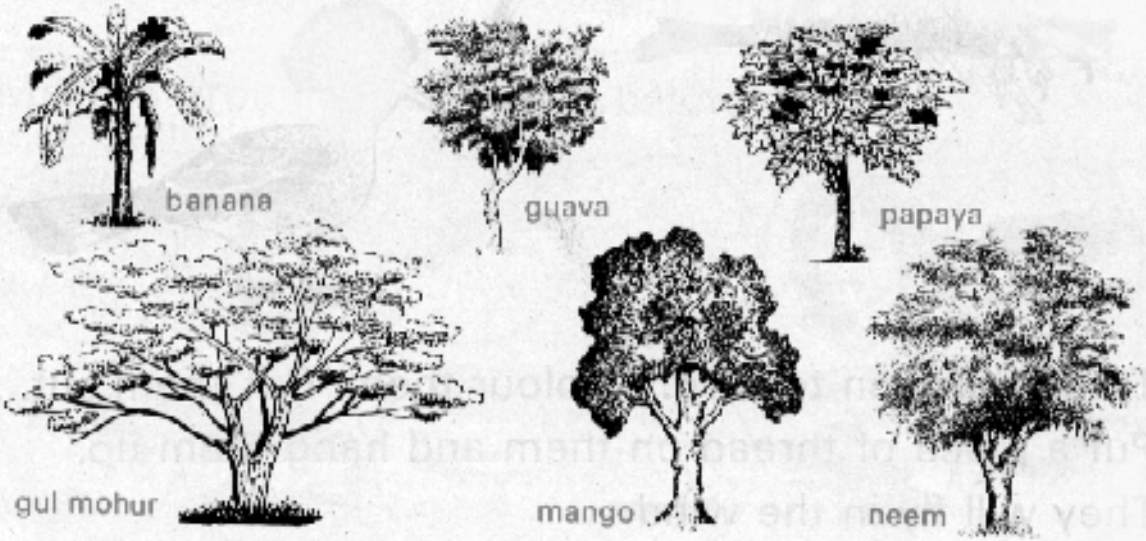
Trace them on to card. Colour them. Cut them out.
Put a piece of thread on them and hang them up.
They will fly in the wind.

Trees and leaves

Collect one or two leaves from trees. See if you can find one of each of the leaves shown below:

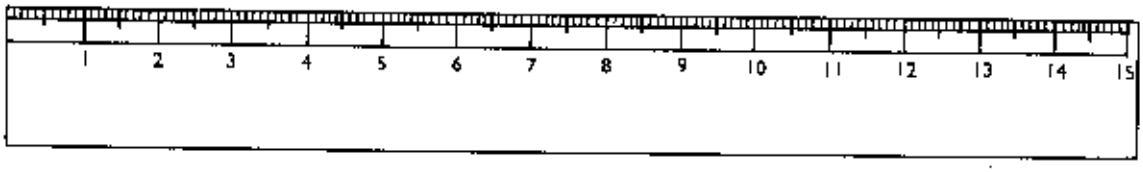


Do you know what trees they come from? Here are the trees, but in a different order. Put the letter of its leaf next to each tree.



Measuring

A ruler



Trace the ruler carefully and copy it on to thin card. Then measure each of the things in the list below. Put the answers in the chart.

	Long	Wide	Thick
Your pencil			
This book			
The top of your desk			
Your thumb			
Your nose			
A new piece of chalk			
Your English Reader			

Measuring liquids

These are liquids. Can you add any more to the list?

water milk orange-juice

Add more liquids here .....

.....

To measure liquids you need :

a cup

a spoon

a bottle

Fill in the chart below : guess first, then measure.

Guess	Correct

How many spoons in the bottle ?

How many spoons in the cup ?

How many cups in the bottle ?

Did you fill the cup and pour a number of cups into the bottle, or

Did you fill the bottle and pour it into the cup ?

Dice

Make two dice, as follows.

Trace the design below on to paper and cut it out. Then put some cooked rice paste on to the parts marked ▬▬ and stick it together.

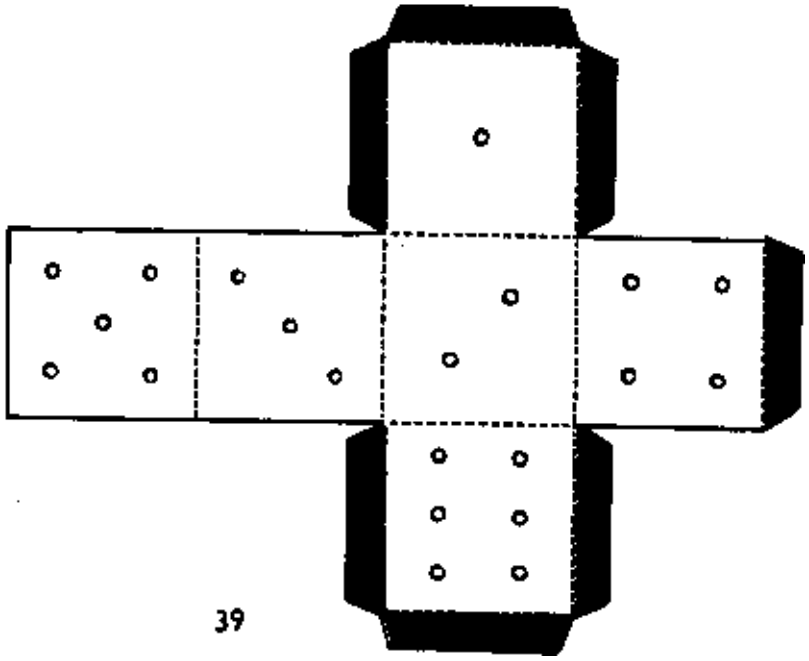
Make **two** dice.

——— means CUT. ---------- means FOLD.

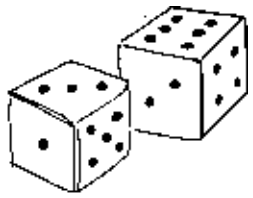
Colour the circles, but don't **cut** them out.

Throw the dice a **hundred times** and mark each number in the chart.

1	2	3	4	5	6



Snakes and ladders



Rules

1 Use two dice. (You made them, page 39.)

2 First player throws both dice and adds score. He puts a piece of chalk or a piece of paper on his square. If he throws 3 and 6 he puts his piece on 9. If he throws 6 and 6 he puts his piece on 12.

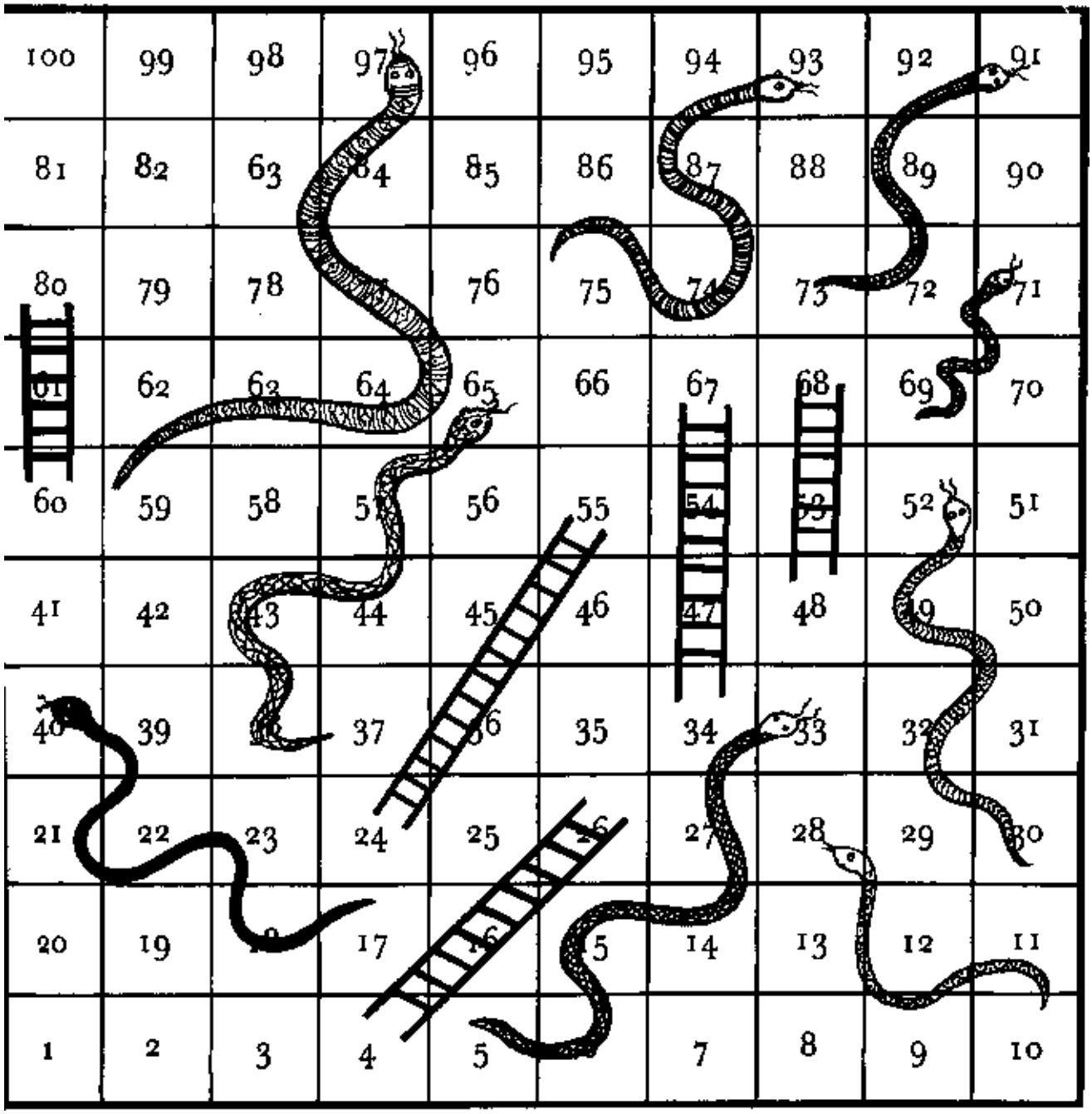
3 If he lands on a ladder he **climbs** to the square at the top of the ladder.

4 If he lands on a snake's head he **goes down** to the snake's tail.

5 Each player plays in turn.

6 The one to reach 100 first, wins.

Snakes and Ladders



Notes for the Teacher

(Notes are only given for those pages where some difficulty may be found, either in the interpretation of the page or in the work preceding or following the work of the text.)

Page 2: Children who finish the work before the rest of the class can try to copy these pictures in their exercise books. Every child should, of course, have a science exercise book as well as the *Workbook;* a great deal of work suggested on each page will have to be done in their exercise books.

Page 5; Being able to trace is a most important skill, and when they have learnt it from the book they can practise by tracing pictures from other textbooks.

Page 6: You may have to help the children by making a large drawing on the blackboard and showing them where to fold and where to cut. Alternatively you can make a large model yourself out of card and show it to the class before you stick it together.

Page 7: See what answers the children give you about the figure at S.

Page 8: This idea that most of the words we use are relative and not purely objective, is continued right into *Book 2.* Of course, measurements are not purely objective, as they relate to an arbitrary scale; but at least it is a scale which everyone accepts. Some interesting discussion can come out of these ideas.

Page 12: Not all children will be able to make the telephone, because, perhaps, not all the children will be able to get tins. The most suitable tin for this telephone is one about eight centimetres high. Plastic containers can also be used.

Page 13: Note the new box labelled *I don't know.* It is important that both you and the children should be able to say these important words quite often.

Page 18: The box diagram is a variation on the Venn diagram, and can be used in a variety of ways. You may have to explain the diagram to the children by drawing a large one on the board and putting some of the answers into it. Clean your work off the board before getting the children to do theirs in their books. Don't forget to get the children to do the work at the bottom of the page.

Page 19: This is the first time the children have been asked to bring something to class. Most of the things asked for in subsequent lessons will not be very difficult to bring, but you must ensure that every child in the class does bring them to school. If the children are going to put things in box diagrams they will have to make the diagrams large enough; each diagram should fill up a complete page in their exercise books.

Page 22: If every child is unable to bring a tin and a bean to class, perhaps this work can be done in groups. Indeed, if your class is large, it may not be possible to accommodate 45 tins of growing beans. The important thing is that some of the children should do it, and that all the children should see it being done.

Page 24: Again, if it is not possible to do these experiments individually they can -be done in groups. If things are to be brought to school for the experiment, a group of four children, for example, can be asked to bring them collectively i.e. one child brings the salt, one child brings the cup, and one child brings the sugar, and so on. Get them to do the experiment themselves; the important thing is that they should do it and not watch you doing it.

Page 26: Perhaps the brighter children in the class can be asked to make similar puzzles of their own and give them to their friends.

Page 27: Guessing is an important skill and in many subsequent lessons children will be asked to exercise this skill. Make sure that the children not only guess, but write down their guesses, and then write down the correct answer which they have found by actual experiment or, as in this case, through verification by you.

Page 29: A case for groups bringing collectively all the things required.

Page 30: Here it is a good idea to get individual children to bring as many things as they can and make the exhibition by themselves.

Page 31: Make sure that the children actually carry out this experiment and report to you in the next class what they have found.

Page 32: Perhaps the children can make nets, one for each group. You will probably have to lead the tadpole expedition yourself.

Page 34: Get children to make questions on these lines for themselves and to give them to their friends.

Page 35: When the children have sorted out the birds from the puzzles, see if they can tell you what birds they are.

Page 37: If children have rulers there is no need to trace them; if they don't, however, they should make their own. If children can be persuaded to bring their own cardboard, or if funds enable you to give them a piece, they should use cardboard; but paper will do.

Page 38: Measuring liquid in the class is a messy business. The best way is to take the children out in the playground and get them to do this work in groups. They can write down the results on a piece of paper and later in their books when they get back to the class. Make sure they write down their guesses before they go into the playground.

Page 39: The children should already have made the house on page 6, and so making the dice may not be very difficult for them.

Page 40: Snakes and ladders is a useful game for revising their addition facts; if they find adding numbers up to 6 easy, you can get them to make new dice with the numbers from 6 to 10 on each side. I have also found useful a pair of dice labelled as follows: 6, 7, 8, 9, 10, 11 (numerals not dots), and —1, —2, —3, —4, —5, —6. If you are using numerals on dice put a line below each numeral so that there is no confusion between the 9 and 6.

David Horsburgh